Continuation of Attachment(s) 6). Other: translation in English of JP59-38655.

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# MEASURING INSTRUMENT FOR PLANT PHYSIOLOGY

## CLAIM(S)

1) A plant physiology-measuring instrument being comprised of two gripping members, an opening/closing member for supporting said both gripping members so as to face each other and move to and away from each other, and plant physiology-measuring sensors mounted on the gripping members, characterized in that an object to be measured, such as a leaf, is gripped by both gripping members to be measured.

2) A plant physiology-measuring instrument, as cited in Claim 1, wherein at least one of said gripping members is formed in a wide-port container shape.

3) A plant physiology-measuring instrument, as cited in Claim 1, wherein at least one of the gripping members contains a section made of transparent material.

4) A plant physiology-measuring instrument, as cited in Claim 1, wherein a sealing member is attached to the peripheries of the opening sections of said griping members, respectively.

DETAILED DESCRIPTION OF THE INVENTION

The present invention pertains to a plant physiology-measuring instrument, particularly to such a plant physiology-measuring instrument that can measure the physiology of plant by placing the instrument directly on the leaf of the plant.

With the prior art plant physiology-measuring device for measuring the light synthesis amount and the light diffusion of plants, the device is equipped with a separately formed assimilative box for accommodating one leaf or multiple leaves of a plant to be measured. This assimilative box and the measuring section are connected with a proper pipe, and carbon dioxide absorbed by or generated from the leaf in the assimilative box is measured.

Said assimilative box is relatively large, and a pipe and a wire must be installed to control the dew points inside the assimilative box. Therefore, the whole device inevitably becomes large, which makes it inconvenient to use it outdoor.

Since the assimilation box and the measuring section need to be connected with a pipe, the total volume taken by the assimilation box and

the pipe becomes high, which decelerates the speed for detecting carbon dioxide and makes the detection sensitivity poor.

The present invention was produced to solve the aforementioned problems, and attempts to present a plant physiology-measuring device that can detect carbon dioxide at faster detection speed and that has a function to measure with excellent detection sensitivity.

The plan physiology-measuring device of the present invention as one embodiment example of the present invention is explained below with reference to the drawings.

Fig. 1 shows a block diagram of one example of the plant physiology measuring device equipped with the plant physiology measuring instrument. In the figure, 1 indicates the plant physiology-measuring instrument of the present invention (hereinafter referred to as the measuring instrument), and this instrument is equipped with a carbon dioxide detection sensor 12, which is an electrochemical sensor using a Voltammetry [sic] as a plant physiology-measuring sensor, and with an oxygen detection sensor 13. By this carbon dioxide detection sensor 12 and the oxygen detection sensor 13, the carbon dioxide discharged from the plant leaf LF (See Fig. 4) attached to the holding section 11 of measuring section and the oxygen inside the holding section 11 are detected. The detected data are A/D converted by an

analog/digital converter 2 and input into the prescribed input terminal of the micro computer 3. By the prescribed arithmetic operation performed by a micro computer, the light synthesis amount of said plant (instantaneous value and accumulated value) is computed. This computed data are displayed on the display device 4, while recording them on a graph sheet by a recording meter 5.

Fig. 2 shows an oblique view of the appearance of the measuring instrument 1. Fig. 3 shows a partial planar view of the key element of the measuring instrument 1. Fig. 4 shows a cut-away side view of measuring instrument. In the figure, 11 and 11 indicate the gripping members formed in a shape of a wide-port container having a wide opening section to be able to surface-contact with the object to be measured. The container consists of circumferential side section 11a and bottom section 11b; the circumferential section 11a is formed in annular ring with a proper thickness, and to one end section of the circumferential side section 11a, the bottom section 11b formed in circular planar shape is secured. This bottom section 11b is partially or entirely made of transparent material, e.g., glass, transparent plastic, or transparent acrylic resin. When the diffusion amount, breathing operation, and assimilation operation are measured under the condition of no light, the bottom 11b needs not be transparent, but it can be

made of non-transparent material or the bottom section 11b may be provided with a light shutter that can be opened/closed. On the side wall of the circumferential side section 11a, a proper sensor-mounting holes 11c are made. To this sensor-mounting holes, the carbon dioxide-detection sensor 12 and oxygen detection sensor 13 are mounted airtight with their detection surfaces facing the inside of the gripping member 11. In the figure, 14 indicates the opening and closing member consisting of nearly angular two supporting rods 141 and 141 and of U-shaped arm sections 142 and 142 attached to longitudinal one ends of the supporting rods 141 and 141. Other longitudinal end sections of supporting rods 141 and 141 are rotatably connected with a pin 141a. By this, the arm sections 142 and 142 and the supporting rods 141 and 141 rotate on the axis of the pin 141a to move to and or away from each other. Between both end sections, both peripheries in the radial direction of said circumferential side section 11a are mounted rotatably by the pin 142a. By so doing, the two gripping members 11 and 11 can be move to and away from each other keeping their openings facing each other. Relay connectors 15 and 16 are mounted at the prescribed places on the arm sections 142 and 142. To their inner side terminals, leads 12a and 13a from said sensors 12 and 13 are connected, and to their outer terminals, are connected one end sections of electrical wires 21 and 22

connected to the prescribed input terminal of the A/D converter 2. On the peripheries of the openings of the gripping members 11 and 11, a proper groove 11d is made along the entire circumference, and in this groove 11d, an O ring 11e is inserted. Instead of the O ring 11e, a proper packing may be inserted in the groove 11d.

Measuring the light synthesis amount of a plant by said plant physiology-measuring device equipped with the plant physiology-measuring instrument of the present invention can be done as follows.

More specifically, the leaf LF of the plant to be measured is gripped by the openings, as shown by the dotted lines in Fig. 4. In this case, a gap should not be left between the surface of the leaf LF and the O ring 11e. To maintain the condition of gripping the leaf LF by the opening sections of the gripping members 11 and 11, the prescribed sections of the supporting rods 141 and 141 are secured with a proper elastic member (e.g., a rubber). By so doing, the O ring 11e slightly eats into the surface of the leaf LF, and the top and back surfaces of the leaf LF are held airtight in the airtight-sealed gripping members 11 and 11. Since the sun ray comes in through the transparent bottom section 11b, the light synthesis of the leaf section covered with the gripping members 11 and 11can be performed without a problem. The carbon dioxide absorbed into the top and back surfaces of the

leaf LF is detected by the sensor 12, and the oxygen inside the gripping members 11 and 11 is detected by the sensor 13. The detected data are supplied to the A/D converter 2 via the leads 12a and 13a and electrical wires 21 and 22. Subsequently, as mentioned earlier, the light synthesis amount (instantaneous value and the accumulated value) are displayed on the display device 4, while being recorded on the graph sheet by the recording meter 5.

As is evident from the explanation about one embodiment example of the plant physiology-measuring instrument of the present invention, the volume of the measuring container of the measuring section is small. Since each sensor for plant physiology-measuring is mounted directly on the measuring container, the detection speed at a time of detecting the carbon dioxide of the plant leaf is faster, and the detection sensitivity is excellent. The detection section is made small, and the whole device is simplified since the pipe and wire required for the prior art device need not be installed, so the device can be easily used outdoor. Also, the top and back surfaces of the leaf LF to be measured can be separately kept airtight, so the top surface and the back surface of the leaf LF can be measured for different items, respectively, or they can be measured for one same item and their measured data can be compared.

In addition, in the above embodiment example, the carbon dioxide detection sensor and oxygen detection sensor are mounted on the measuring container of the detection section as the plant physiology measuring sensor, but the types of sensor is not limited to them. Other types of sensors, e.g., a leaf temperature sensor, the sun ray sensor, and a water content sensor, may be mounted.

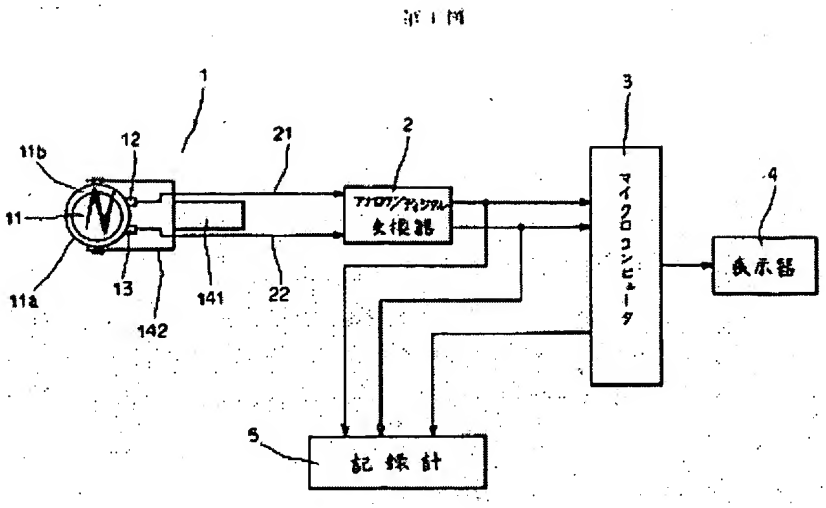
In the above embodiment example, both gripping members 11 and 11 are formed in a wide-port container shape, but the shape is not limited to it. If one of the gripping members is formed in a wide-port container shape, the other gripping member may be formed in a planar shape.

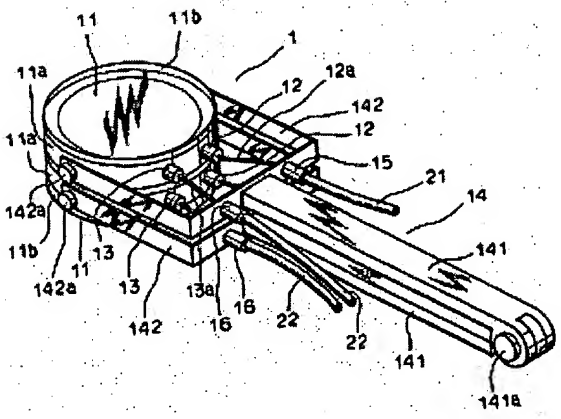
Moreover, in the above embodiment example, the bottom sections 11b of both gripping members are made of transparent material, but the whole body of one or both gripping members may be made of non-transparent material.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a block diagram of one example of the plant physiology-measuring device equipped with the plant physiology-measuring instrument of the present invention. Fig. 2 shows an oblique view of the appearance of the plant physiology-measuring instrument of the present invention. Fig. 3

and Fig. 4 show a planar view and cut-away side view of the key elements, respectively.




Translations
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Akiko Smith